



**FEASIBILITY STUDY REGARDING
THE SHARED AND ENHANCED DELIVERY
OF TECHNOLOGY SERVICES
BETWEEN THE
CITY OF NEW ROCHELLE
AND THE
CITY SCHOOL DISTRICT OF NEW ROCHELLE**

October 2010

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Introduction

Objectives

In response to the requirements identified in request for proposal SPEC # 4851 Black Box Network Services (hereafter BB) took a comprehensive look at technology and information systems services as they were being delivered and utilized in the City of New Rochelle (hereafter City) and the City School District of New Rochelle (hereafter District). The primary objective of the study was to determine opportunities for service improvement or cost savings that may be possible through network integration, cooperative procurement, and consolidated services. Specific needs addressed by the study included:

1. Cost containment of operations and maintenance of technology services.
2. Assessment of capital improvement schedules and costs.
3. Equipment and software audits.
4. An assessment of technology procurement policies and practices.
5. Assessment of all operational costs associated with technology services.
6. Assessment of the demand for technology services throughout the community.

A secondary objective of the study was to update the network documentation from the District's February 2008 EDUTEK study, and develop similar documentation for all City locations.

Scope

As the study got underway it was determined by the team that cost data, desktop inventories and software audit data were all readily available to the City and District. Therefore, project resources were not expended exploring these areas.

During the project, we focused on the technical and cost control opportunities available to the two entities. Our baseline assumption was that anything that was technically feasible and cost justified was possible. Organizational, political, and/or regulatory impediments (if any) were not considered in the development of our recommendations, as these are beyond our area of expertise.

Information Sources

Extensive discussions were held with Christine Coleman and Peter Campone, project team leaders for the District and City respectively. These individuals also provided reference documentation. Following these discussions, tours were made of all the data centers, wiring closets, and telephone company demarcations at 14 City locations and 12 District locations (see appendix A for a list of all locations visited). During each such tour BB representatives were accompanied by the technical personnel responsible for installation, operation, and maintenance of those specific facilities. City and District staff were also interviewed as available and appropriate.

Organization of Report

Including this introduction as Section 1, the report consists of six sections. Section 2 presents an overview of the City and District as a combined entity, highlighting areas where shared services and system integration can provide cost savings and or operational improvements. Section 3 discusses issues directly affecting the City. Some of these have already been touched upon in Section 2, but in this section they are addressed from the perspective of the City. Likewise Section 4 covers the District's issues and perspective. Section 5 provides a summary of recommendations and more specific action plans for each. Finally, Section 6 includes appendices containing location listings, drawings, and other information specific to each location.

Combined Overview

Network

Although they use totally different technologies and services, from the "10,000 foot" view the City and District networks are remarkably similar. They each have a very robust wide area network topology, with data links converging in the carriers' network cloud. This means that from a connectivity standpoint loss of any one location will not interfere with communications among the others. On the City side this connectivity is provided by Cablevision (also referred to as Lightpath or Optimum) under their contract with Westchester County. On the District side the connectivity is provided by the Lower Hudson Regional Information Center (LHRIC) which is part of BOCES. The LHRIC services ride on circuits provided by Verizon.

Both entities have centralized server resources that are accessed by clients in remote locations over the network; and both use a combination of on-site and online backup. The disaster recovery strategy for both entities is to restore the backups to either on-site or off-site hardware as necessary to resume operations.

Finally, from a voice perspective, both use carrier services on a separate network to communicate with "the outside world." District services are provided by PRI and Centrex from Verizon, while City hall services are provided by Lightpath PRI's with some Verizon Centrex lines as backup. City remote locations are all on Verizon Centrex. Internally both use a combination of Centrex and PBX systems. The District uses a variety of older technology analog and digital equipment, while the City has also implemented a Voice Over IP (VoIP) system at City Hall, the Police Department, and one downtown office location. While the technology of these various systems is quite different, the basic function of distributing delivered calls and handling person-to-person communication is the same across them all.

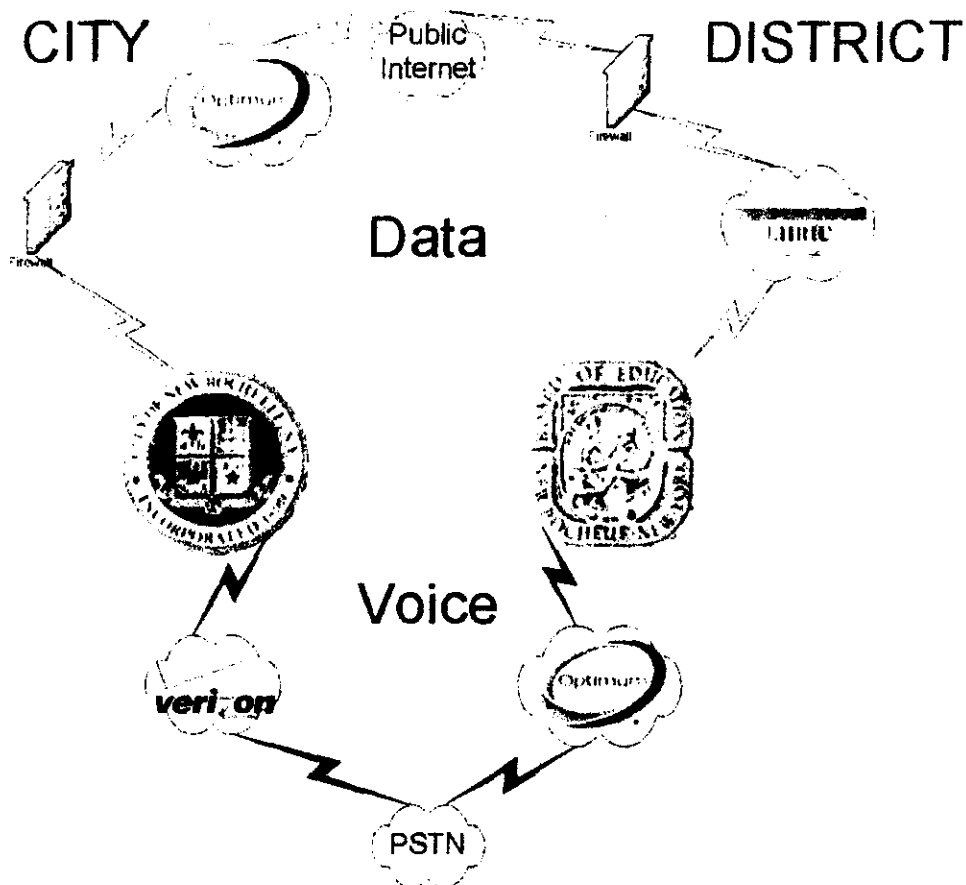


Figure 1 - New Rochelle Data and Voice Networks

There is one key critical difference between the two networks. All District locations access the Internet via the LHRIC cloud, while all City locations access the Internet through the connection at City Hall. In the former case, functions such as firewall and filtering are handled by LHRIC; while in the latter case these functions are provided by hardware and software in the City Hall data center. The effect of this difference is that loss of connectivity at City Hall will eliminate Internet access for all City locations. There is no similar single point of failure on the District side.

Key Opportunities

At the outset we would like to comment that we are very impressed with the overall network design and implementation exhibited by both entities. Likewise the personnel we met with were professional, knowledgeable, and have a great attitude. Starting with such a well thought out network managed by a competent team allowed us to focus on areas of enhancement and opportunities for synergy rather than remediation. As we developed the recommendations we found that they fell into three broad categories: Business Continuity/Emergency Operations, Cost Control, and Public Safety.

Business Continuity/Emergency Operations

As mentioned above both entities have solid backup strategies that will allow them to restore systems on new hardware, or at a different location, in the event of a serious failure. The key word here is "restore." This by definition involves a period when service was interrupted. Taking emergency preparedness to the next level entails constructing the systems and network such that the majority of personnel can continue their work without interruption during a system outage. In this regard we focused on two areas: environment and network design. The environmental factors are intended to reduce or eliminate circumstances that could cause the systems to go down, and the network design focuses on distributing and duplicating the resources such that there is no single point of failure.

Environmental Factors

When it comes to preventing outages the two major factors under our control are power and the physical environment in which the equipment is kept. As discussed in further detail below power is a concern at all City facilities, as well as in the District offices.

By far the most critical power related risk is the backup generator at City Hall. It is our understanding that this equipment is nearly 50 years old, and that significant problems have impaired its performance in the latest round of functional testing. Failure of the generator during an extended power outage will have a devastating impact on the following systems:

- City data center.
- District administrative data center.
- Fire Department Headquarters.
- The City Emergency Operations Center (EOC).
- Telephone service for City Hall, Housing/Section 8, and the District administrative offices.
- Internet access for all City departments.

In fact the only City entity that will remain up and running during such an event is the Police Department who had a new generator installed when their building was last remodeled. The PD will, however, lose a significant portion of their voice and data capacity as their primary Internet connection and two of the three Verizon PRI circuits run through the City Hall data center.

With regard to the physical environment, both the District and the City data centers appear to be well protected and have the appropriate climate controls. The same cannot be said, however, for many of the endpoints on both networks. The primary concerns are heat and access to the equipment, as described below. While in aggregate these factors do affect the overall reliability of technology services, specific failures will only affect a local user population such as a single City department, or a particular wing of one of the schools. As such addressing these problems is frequently squeezed out of overall technology plans by more visible issues. This is unfortunate in that relatively small and easy to implement fixes

issues. This is unfortunate in that relatively small and easy to implement fixes can be made now that will prevent future failures that may entail operational outages and/or expensive equipment replacement.

Network design

As mentioned above both the City and the District have very robust wide area network architectures, each running on a different carrier platform. This provides an excellent foundation to support the move from disaster recovery to business continuity. During our review we were able to identify five "single points of failure," the loss of any of which would significantly impact the ability of the City or District to continue operations. They are:

- The generator at City Hall as discussed above
- The City Hall data center
- The City Internet connection at City Hall
- The District administrative data center at City Hall
- The District applications data center at the High School

In this context when we talk about "data center" we are also including the loss of a critical server within that data center. Both entities are in an ongoing process of weeding down the number of physical servers required for operations through the use of virtualization. This increases the reliability of the services run on such servers, while decreasing the cost and power consumption. Consolidation of multiple services on a single machine also sets the stage for implementing hot standby or "mirror" sites.

In a mirrored configuration servers at two different physical locations simultaneously run the same applications while constantly replicating the data between each other. Therefore loss of one server has no effect on continuing operations as the load is immediately taken up by the other one. This requires high-bandwidth connections between locations, but that is not an issue on the District network. The default bandwidth is 100 Mb per second, and this can be "dialed-up" as necessary to support mirror applications.

Implementing mirroring for the City servers is a slightly different story. The only connection with sufficient bandwidth to support mirroring is that to the Housing/Section 8 office. That office does not have sufficient space, however, to install the requisite hardware. Interconnection of the two networks is one way to resolve this issue. With the networks interconnected the City mirror site can be placed in one of the District locations, using that site's high-speed connectivity, while still being available to all of the locations on the City network. This will also address the issue of Internet access for the City facilities should the primary connection be lost, as they would all have an alternate route through LHRIC.

In general there are three ways of interconnecting the two networks:

1. A "cloud to cloud" connection between the Cablevision/Westchester County network and the Verizon/LHRIC network. In point of fact such a connection already exists as all carriers at that level are interconnected. The challenge is to work out the

The challenge is to work out the provisioning of a private network connection between the two such that City workstations on the Cablevision network can access District resources without going outside of the LHRIC firewall.

2. At least two high-bandwidth interconnections between separate City and District locations. Obviously one of these would be a fiber connection between the District and City data centers which are both located in City Hall. A second pair would be required to provide redundancy. This will entail upgrade of the selected City location to provide both a high-bandwidth connection to the Cablevision network and a point-to-point fiber connection to one of the District locations.
3. The third option is use of a VPN connection through the public Internet. This will require opening the Cablevision connection, and providing a gateway/firewall device, at each City location to allow direct Internet access.

We note that much of the core Cisco switching equipment in both the City and District networks is either end of sale (EOS) or end-of-life (EOL). This includes the 1700 series routers in most City locations, as well as the 6500 and 3500 switches that are the core of the District network. It will become increasingly difficult to support these products across the three year planning horizon, as support and manufacture of spare parts for most of them end in 2011 or 2012.

Network interconnection and an expansion of VoIP services will also create some interesting opportunities to increase the survivability of voice services. Since each entity uses a different primary carrier (Verizon and Lightpath) it is theoretically possible to construct a failover plan should one or the other carrier experience a local or regional outage. While such events are extremely rare, they do happen. While we do not think a focus on such interconnection at this time is a priority when compared to some of the other network opportunities, this concept should be kept in mind as part of the long-term network design and plan.

Cost Control

Our study uncovered a variety of opportunities to control and reduce costs including joint purchasing, managed print services, VoIP, and power conservation.

Joint Purchasing

It is obvious that the District purchases significantly more technology equipment, services, and supplies than the City does. Likewise, the District purchasing consortium, BOCES, has far greater purchasing power than Westchester County. This purchasing power allows the District to obtain better pricing on a wide variety of goods and services. Further, the availability of pre-negotiated contract pricing for a variety of commodities can reduce the cost to the City of acquiring such goods and services.

Managed Print Services

Many vendors and manufacturers are offering managed print services as an alternative to the traditional purchasing of printers and consumables. In these arrangements the vendor provides the printer, toner, paper, and ongoing maintenance services, typically charging monthly for actual usage on a per page basis. The intelligence and network connectivity of the print devices allows them to track and report on usage and manage supplies. On a TCO basis the cost of managed print services is typically less than the cost of buying and supplying printers and paper. More importantly, managed print services provides two key economic advantages:

1. It aligns the timing of printer costs with usage converting a capital outlay to an operating expense.
2. It provides individual visibility and accountability for printing expenses. Such individual accountability is far more effective in reducing print volume than measures like little notes at the bottom of e-mails saying "do not print this unless you need to." Reduction of print volume, in addition to saving the cost of printing, reduces power consumption and environmental impact. Further, to the extent that individuals do not or cannot reduce their printing volume, the reporting provides management with the ability to identify high-cost print operations and either seek alternatives or budget appropriately.

VoIP

When used within the enterprise, as is the case with the City and PD systems, VoIP can provide cost and operational advantages. These include significant reductions in the cost for moves adds and changes, productivity enhancements such as unified messaging, and the elimination of the ongoing Centrex charges for each individual phone line. The City has made an investment in the Cisco VoIP infrastructure, and it certainly makes sense to leverage that investment as legacy telecommunications hardware reaches obsolescence at City and District locations.

VoIP services can also provide cost advantages when used to replace traditional carrier voice services. Both Cablevision and Verizon, as well as a host of other players, are bringing VoIP services online that greatly reduce or eliminate the cost of in-state, interstate, and international calls. We understand that Lightpath delivers services to City Hall via traditional voice PRI. An interesting avenue of inquiry would be the extent to which these services may be delivered over the IP network, and further deployed to the remote locations as an IP Centrex working in conjunction with the existing Cisco call managers.

Power Conservation

Power conservation is another area where small steps taken throughout the enterprise can have a large impact. In addition to the savings resulting from the virtualization and print management initiatives discussed above, and better management of heat in equipment rooms as discussed below, the power sapped by peripherals (including such things as cell phone chargers, monitors, printers, etc.) is being increasingly recognized as a target for

is being increasingly recognized as a target for conservation. Timer equipped surge protectors automatically turn peripheral devices off at night, and make it easy for users to turn them back on in the morning. Such devices should be used wherever possible.

Another opportunity is the replacement of end-of-life network infrastructure components with newer "green" replacements. Manufacturers continue to make advancements in lowering the power utilization of their equipment, and many are offering incentives for upgrade to the new versions. Likewise there may be grant funds available through various state and federal agencies to support such initiatives.

Public Safety

During our meeting with the Police Department we discovered that effective utilization of their primary case management and investigative applications requires more bandwidth than is available over the current generation cellular network. This means that officers frequently come into headquarters to do many functions that otherwise would be performed from the workstations in their patrol vehicles. Making high-speed Wi-Fi connections available in the parking lots of all the schools will provide the officers with islands of connectivity, allowing them to work with these applications without taking them off the street. A natural result of this will be an increased police presence in the school parking lots at all hours of the day and night, providing improved security for school property and personnel. Finally, such connectivity will allow real-time access to the schools CCTV security systems for police responding to an incident.

Recommendations and Action Plans

Combined

Generator at City Hall

Action Plan

- Power engineer determine start-up and draw requirements for:
 - Data Centers
 - Wiring Closets
 - Telecommunications
 - EOC
 - Workstations
 - Lighting
 - HVAC
- Purchase and Install appropriate generator
 - RFP or Established vendor
- Run full load test

Time Frame

High priority. Will take three to six months to complete.

Wireless in School Parking Lots

Action Plan

- RF engineering survey of all school buildings/lots to determine equipment requirements and optimal placement.
- Purchase and install appropriate hardware in Schools
- Determine software requirements, if any, for PD access to CCTV
- Purchase and install appropriate hardware and software in Patrol Vehicles (if any).
- Establish appropriate SOP/SOG for Patrol Officers and train as necessary.

Time Frame

Immediate need and benefit. Fast turn around if bidding is not required. Will take four to six weeks to complete.

Server Virtualization

Action Plan

- Continue ongoing initiatives in both City and Schools.

Time Frame

Ongoing as part of technology plan.

Interconnect Data Networks

Action Plan

- Evaluate opportunities for interconnection at carrier level in addition to fiber link in City Hall
- Internet Fail-Over for City Network
 - To School network
 - Alternative gateway site
 - Via the WAN with local security

Time Frame

Ongoing as part of technology plan. Priority will increase to support mirroring and/or VoIP initiatives.

Mirror Locations

Action Plan

- Id location for School Admin and App servers
 - One for the other or third site for both

- Determine feasibility of adding City App servers
- Adjust bandwidth as required
- Install and test necessary hardware and software
- Make appropriate routing changes

Time Frame

Priority to be determined by organizations involved. Prerequisite of network interconnector if City facilities are included. Project duration between three and six months.

Managed Print Services

Action Plan

- Collect inventory of existing printers by type/location
- Determine or estimate monthly usage
- Procure managed services via RFP or existing vendor

Time Frame

May result in significant cost savings. Data collection and cost comparisons should take between four and six weeks.

Reduce Power Demand

Action Plan

- Peripherals
 - Continue to use network commands to shut down and power up CPUs.
 - Procure and install power strips with timers that will automatically shut down peripherals.
- Core
 - Continue server virtualization initiatives.
 - Identify network switching components that are EOL or fully depreciated (e.g. Cisco 65xx switches) and evaluate greener alternatives
 - Vendor upgrade/trade-in programs
 - State and Federal Grants

Time Frame

Ongoing as part of technology plan. Incorporate into other projects such as workstation upgrades, VoIP implementation, Wire Closet upgrades, etc.

Address Environmental Concerns

Action Plan

- Insulate all AC exhaust vents where they run through conditioned space.
- Consolidate cabinets and racks where appropriate
- Place equipment in secure cabinets when not in secure, dedicated rooms.
 - At least place on shelves rather than balanced on table edges or on the floor under desks.

Time Frame

Heat management a priority for completion prior to next summer. Physical security enhancements should be incorporated into ongoing maintenance and technology plans.

VoIP Rollout

Action Plan

- Explore Carrier VoIP Alternatives
 - SIP trunking to replace PRI and POTS at Call Manager or PBX locations
 - BC-OOL voice offerings for remote City sites.
- Roll out Call Manager VoIP services to Schools and remote City locations as appropriate.

Time Frame

Carrier discussions can begin immediately. VoIP roll out will range from one month for a small City location to four months for a large school.

District

VoIP for District Offices

Action Plan

- Station survey in District Office to determine phone types and configuration
- Re-allocate existing POE switches, purchase additional units as required
- Upgrade Call Managers at City Hall and PD as/if necessary
- Run fiber connection between City and District data centers
- Install and train

Time Frame

Could be done at any time, though it is suggested that cutover be planned to coincide with school vacation. Implementation time thirty to sixty days.